



# **Department of Defense Legacy Resource Management Program**

**PROJECT NUMBER (13-631)**

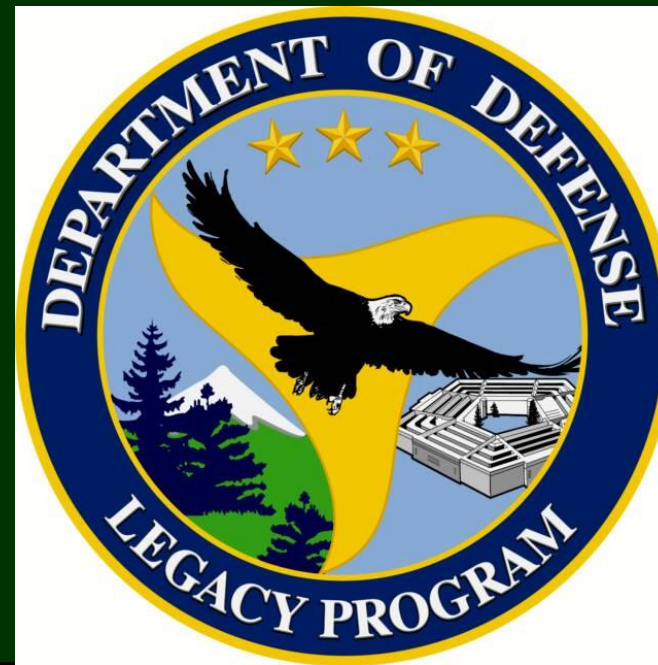
**Status and Distribution Modeling of Golden  
Eagles on Southwestern Military Installations  
and Overflight Areas: Assessing “Take” for  
this Sensitive Species at Risk  
Year 2 – Conference Poster**



# Predicting high likelihood Golden Eagle nest habitat and assessing occupancy across military lands and their overflight training routes – Year 2.



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## Abstract

Golden Eagle (GOEA; *Aquila chrysaetos*) management has become a top priority in the desert southwest as potential breeding habitats continue to be altered by human development and activities. This project focused specifically on military disturbance associated with military training routes (MTR) and Bald and Golden Eagle Act (BGEPA) compliance. In 2014, our efforts combined with in-kind support resulted in 333 unoccupied nests and 153 occupied GOEA nests with 268 of these surveyed multiple times throughout the breeding season. Using a presence-absence framework and 1,102 potential nest sites, we analyzed 10 topographic and climatic covariates potentially associated with GOEA nest habitat within each of the 4 Bird Conservation Regions (BCRs) in our study area. Our top preforming regression model visualized high-likelihood GOEA nesting habitat through a Geographic Information System (GIS). Finally, nest occupancy within military disturbance areas (MTR; N=102) versus outside (Non-MTR; N=166) resulted in no significant difference. Application of these models may help focus future survey efforts for GOEA nests and develop a framework to monitor and compare occupancy based on specific disturbance types to determine compliance with BGEPA.

## Introduction

This Department of Defense (DoD) Legacy Program project (13-631) was designed to determine the reproductive status and model distribution of GOEA nesting habitat within and adjacent to DoD managed lands in the southwestern United States to inform acceptable GOEA “take” limits under the BGEPA. GOEA are primarily cliff-nesters (Kochert et al. 2002) generally associated with rugged terrain (McIntyre et al. 2006). Much of this area is not included in current GOEA assessments (containing ~ 80% of the breeding GOEA population [Millsap et al. 2013; Nielson et al. 2014]). In addition, human disturbance in otherwise “natural landscapes” have resulted in adverse impacts to nesting GOEA (Frackler et al. 2014; Steenhof et al. 2014).

Identifying GOEA nests and their status on a landscape scale has been a challenge, and current methods for most southwestern states have been to use remotely sensed data to identify potential cliff structures (e.g., McCarty and Jacobson 2011; Tack and Fedy 2015). Use of specific information on nest sites and new terrain evaluation techniques (Sappington et al. 2007) can help improve current model predictions.

Our objectives included:

1. Survey potential habitat for nesting GOEA
2. Model distribution of GOEA nests
3. Model GOEA nest occupancy and determine potential influence by military disturbance (MTR vs. Non-MTR)



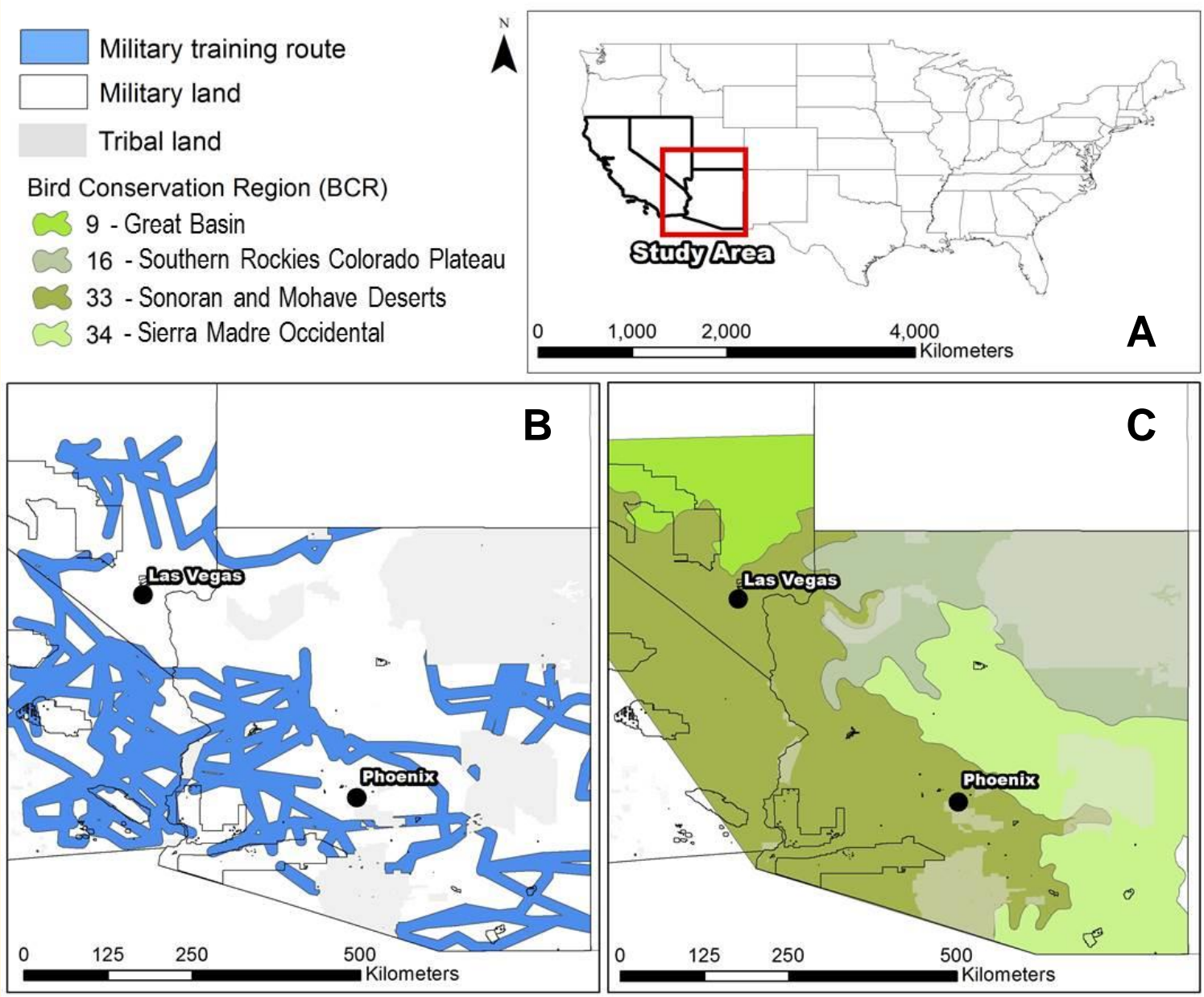
Golden eagle nesting on a ledge outcrop.

## Methods

### Primary survey strategies



### Study Area



Study area within the southwestern U.S. (A) with identified MTRs (B) and BCRs (C). Tribal lands (gray fill; B) were excluded from analysis.

### Surveys included

- Mapping of surveyed areas
- GPS locations of nests
- Demographic data (e.g., incubating, brooding, number of young, etc.)

### Modeling nest distribution

- Regressed 10 landscape covariates on known nests and random selection of surveyed areas with no known nests and within each BCR and displayed graphical model results for each.

### Occupancy analyses

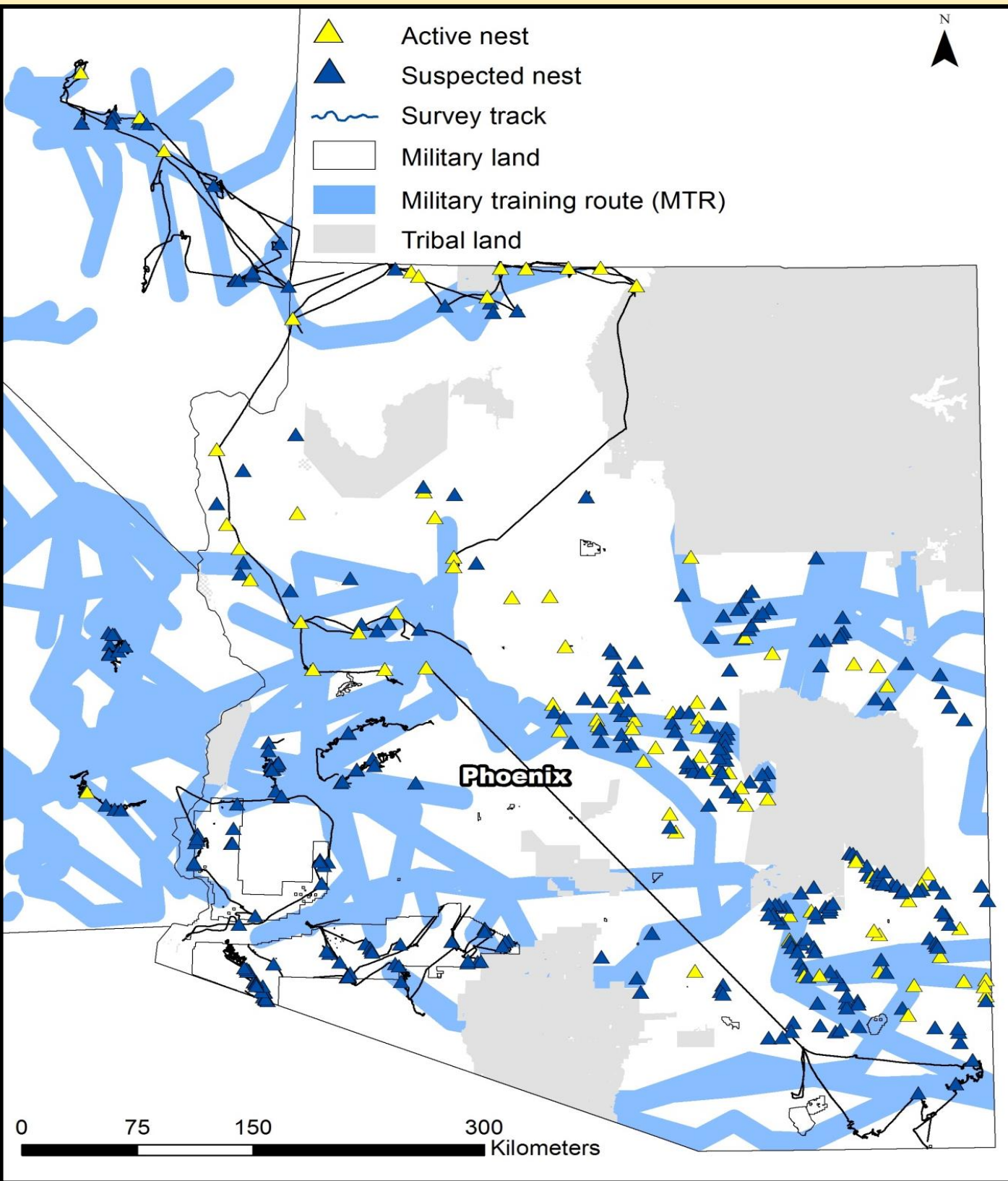
- Compare GOEA nesting occupancy within each BCR, within and outside of MTR, and across 2 years of surveys.
- Model demographic parameters against 10 individual landscape covariates to determine driving factor for occupied vs. unoccupied nests.



Military aircraft flying over rugged terrain potentially suitable for golden eagle nests.

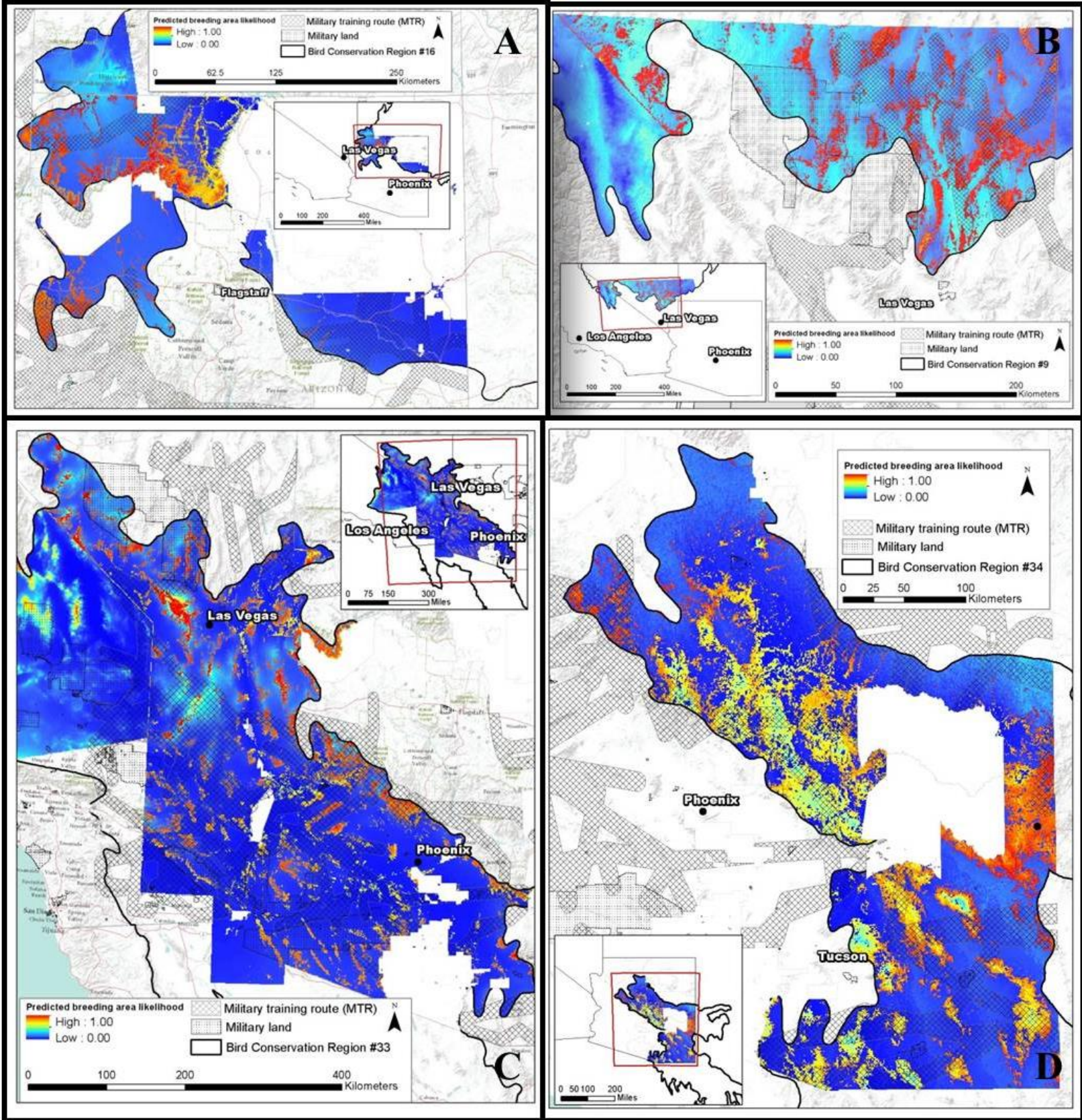
## Results

- Surveys identified 486 potential GOEA nests with 153 being occupied .



Summary results of GOEA nest surveys in SE Nevada, S California, and Arizona. MTRs are shown in blue, with survey routes (lines) and nests (occupied = yellow; unoccupied = purple). Nest locations from Nevada Department of Wildlife not shown.

- Modeled distribution of GOEA nesting habitat across the landscape using 551 potential GOEA nests and 551 non-GOEA nesting locations.



Predicted golden eagle nesting likelihood in the southwestern United States in 2014 by Bird Conservation Region: BCR-16 (A), BCR-9 (B), BCR-33 (C), and BCR-34 (D).

- No statistical difference in occupancy in either 2013 or 2014, but higher rate of successful nests under MTR-designated airspace.

	2013			2014		
	N*	Ψ (MEAN)	SE	N	Ψ (MEAN)	SE
BCR 16	49	0.37 <sup>AB</sup>	0.07	43	0.40 <sup>A</sup>	0.08
BCR 33	91	0.27 <sup>A</sup>	0.05	30	0.40 <sup>A</sup>	0.09
BCR 34	77	0.47 <sup>B</sup>	0.06	193	0.24 <sup>A</sup>	0.03
BCR35	-	-	-	2	0.50 <sup>A</sup>	0.49
MTR	66	0.33	0.06	102	0.30	0.05
non-MTR	154	0.38	0.04	166	0.28	0.03
Totals	220	0.36	0.03	268	0.29	0.03

\* For BCR, total breeding areas included a total of 217 sites. Three sites were removed due to incomplete data.

\*\* Significant pair-wise differences computed by year with Tukey's HSD ( $\alpha=0.05$ ).

Calculated occupancy ( $\psi$ ) from surveys conducted in 2013 and 2014 for Bird Conservation Regions (BCR) and military lands (MTR) in Arizona.

- Modeled occupancy displaying annual precipitation (Bio12) as highest likely variable driving nesting occupancy (i.e., incubating or brooding).

## Conclusions

- No difference in occupancy between BCRs in 2014, and no difference in occupancy under MTR-designated airspace suggesting compliance with BGEPA within our measured parameters.
- Nests were more successful within MTRs suggesting potential benefits within MTR designated airspace.

Although this project was designed to evaluate nest distribution and reproductive status of GOEA within military disturbance areas (i.e., MTR), but rather to develop models that can help direct complementary management supporting both mission objectives and environmental compliance.

These models may have additional benefits beyond military application and may help address and quantify potential impacts from other sources of human disturbance.



Golden eagles utilizing a wildlife waterer adjacent to high-likelihood nesting habitat.

## Management Recommendations

1. Continue monitoring known and suspected GOEA nests to better understand temporal breeding patterns.
2. Coordinate with local authorities on current status and distribution of GOEA nests.
3. Develop avoidance zones around known GOEA nests occupied in the past 5 years during the breeding season.
4. Avoid disturbance of suspected GOEA nests and high likelihood nesting habitat during the early breeding season.

## Acknowledgments

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